UNPUBLISHED
SURVEY & CONTROL
REPORTS

INTERMOUNTAIN STATION
Central Reference File
No. 3.4143-41

FOREST INSECT SURVEY REPORTS

of the

ALASKA FOREST RESEARCH CENTER
U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE

Number 7 March 1961 Juneau, Alaska

BIOLOGICAL EVALUATION OF A BLACK-HEADED BUDWORM INFESTATION IN SOUTHEAST ALASKA SEASON OF 1960

G. L. Downing, Entomologist

FOREST SERVICE
INTERMOUNTAIN
RECEIVED
JUL 24 '61
FOREST INSECT LAB.
MISSOULA, MONT.

INTRODUCTION

In 1959 an outbreak of the black-headed budworm (Acleris variana (Fern.)) and the hemlock sawfly (Neodiprion tsugae Midd.) occurred in the hemlock-spruce stands of southern Southeast Alaska (4). Concurrently a similar situation existed just south of the Alaska panhandle in the Queen Charlotte Islands of British Columbia (9). The high 1959 populations were viewed with considerable concern because of the destructive nature (1, 11) of the last outbreak of these two pests when they swept through the entire panhandle of Alaska from 1948 to 1955 (6). Little information was obtained regarding the 1959 infestation in Southeast Alaska, but this fragmentary information, plus the reports of the Queen Charlotte outbreak were sufficiently alarming to warrant increased survey coverage in Southeast Alaska in 1960.

Surveys made in 1960 were: (1) an egg survey of the overwintering 1959-60 population conducted in May; (2) the regular larval sampling program during June and July; (3) a special larval sampling program in July and August; and (4) an egg survey of the overwintering 1960-61 population made in late September and early October.

Data from these surveys are contained, by sampling locations, in Table 1 and are keyed to the map in Figure 1.

This report is concerned only with the surveys listed above. For information concerning past outbreaks of these pests in Alaska and information on their biology refer to the references already given and to

FILE COPY MISSOULA FOREST INSECT LABORATORY

references (2, 3, and 7).

EGG SURVEY - 1959-60 OVERWINTERING POPULATION

Purpose - This was the first attempt to delineate the infestation area and the relative population levels within the area. The limited number of samples obtained were intended to give rough estimates of population levels and a rather broad interpretation of the infested area. The survey was intended as a guide to later surveys and as a base from which to evaluate future overwintering black-headed budworm and hemlock sawfly egg populations.

Methods - This survey was made by G. L. Downing from May 2-20, assisted for a few days by H. E. Hayes of the South Tongass National Forest and D. Ruff of the Craig Ranger District. Samples were obtained from thirty-four scattered locations. The sample from each location consisted of five ten-inch branches from each of three different hemlock trees, or a total of fifteen ten-inch branches per location. Branch samples were taken from the small residual trees left in clear cut areas or from trees along the beach fringe. In most cases branch samples were taken from the lower-crown or mid-crown and from within hand reach of the ground. The method used was patterned in part after the method suggested by G. T. Silver (8). The main difference being his recommendation that samples be obtained from the top-third of the tree crown. Sampling from the top-third of the tree crown was considered but not used because of the additional cost required to fell, or otherwise obtain samples from the top portion of large hemlock trees.

Samples were counted in Ketchikan, which served as the base of operations. Transportation to the sampling sites was by use of a chartered Cessna 180 aircraft on floats.

Samples were placed in a constant (40°F.) temperature room at a cold storage plant to prevent needle drop prior to egg counts.

Results (fig. 2) - The total number of twig inches in each collection of 15 ten-inch branches was counted. The number of black-headed budworm eggs in each collection was compared on the basis of eggs per twig inch, as used by McCambridge (5) and on the number of eggs per branch, as used by Silver (8). By both methods all collections were in the light defoliation class. The ranges being none to .11 eggs per twig inch and 0.1 to 6.1 eggs per branch. Since the methods used in obtaining the samples did not follow exactly along the lines used by either McCambridge or Silver, the results could only be interpreted as tentative. A more complete evaluation of the egg counts would have to await the completion of larval feeding and a check of defoliation in each area.

This survey, while indicating that defoliation generally would be light, did not contain enough samples to measure the extent of the infestation. No egg survey was made of the previous generation, therefore no estimate of infestation trend could be made. In this connection egg parasitism was noted in only 8 of the 34 collections and did not exceed

twenty percent in any collection.

Hemlock sawfly eggs were included in the count for all samples. The occurrence of sawfly eggs was sporadic and the number fluctuated widely. Most of the samples did not contain sawfly eggs. In the nine samples where they did occur, four contained 70 or more eggs each.

REGULAR LARVAL SAMPLING PROGRAM.

Purpose - This program provides information on larval populations of most defoliators infesting forest tree species of Alaska. This is a new program that is not yet fully functional. When it becomes functional, the more important forest areas will be covered extensively each year. Other types of intensive survey will be necessary for coverage of outbreak situations.

Sampling in 1960 included portions of the black-headed budworm infestation area. While this sampling method includes a wide variety of host tree species and most defoliators, this report includes only the information pertaining to the black-headed budworm and hemlock sawfly from western hemlock samples.

Methods - This survey was made by W. E. Rose and R. L. Tierney, of the Alaska Forest Research Center, from June 13 to July 21.

Each sample consisted of the number of black-headed budworm and hemlock sawfly larvae taken from a three-tree beating on a nine by seven foot cloth. A twelve foot beating pole was used. All samples were obtained from the beach fringe.

The M/V Maybeso served as transportation and housing for the two man crew.

Results - A total of forty-seven samples were obtained. From the standpoint of assessing the black-headed infestation these samples were unevenly distributed (fig. 3). They show that relatively high populations existed in the Thorne Bay - Karta Bay area, Naha Bay, and George Inlet and that moderate populations existed in Thorne Arm and along the west side of Cleveland Peninsula. Elsewhere populations were generally light; however, few if any samples were obtained from many of these areas. This is particularly true of the west coast of Prince of Wales Island.

Hemlock sawfly samples generally, but not consistently, followed the same population pattern as the black-headed budworm (fig. 4).

SPECIAL LARVAL SAMPLING PROGRAM

Purpose - This program was undertaken to determine the relative abundance and distribution of the black-headed budworm. The spring egg survey and

the regular larval survey showed that the budworm population was sporadic over the known outbreak area. However, these two surveys were too limited in coverage to adequately show the distribution and abundance of the budworm. Also, it was not known whether the population was on the rise or fall. If on the rise, it would be important to have a general knowledge of these two factors for the 1959-60 budworm generation. This information would then be useful as a base for comparison in following the infestation trend in succeeding generations.

Methods - D. Crosby was detailed from Region 7 of the U. S. Forest Service for this project. He was in charge of the survey assisted by W. E. Rose and R. L. Tierney. Collections were obtained from July 13 to August 13, but most of the samples were collected during the last two and one-half weeks of this period.

Each sample consisted of the number of black-headed budworm found on three eighteen inch hemlock branches. The three branches were collected from separate trees. All branches were obtained from beach fringe trees and from within hand reach of the ground. The three branches from each location were placed in a plastic bag and taken to the Research Center's Hollis Camp where the larvae were counted. The Hollis Camp served as the base of operation for this survey.

Transportation to collection sites was by airplane or boat. A Cessna 180 aircraft on floats was chartered out of Ketchikan for air travel. The M/V Maybeso and skiffs from the Hollis Camp provided water transportation.

Results - This survey found that the heaviest budworm populations were confined to the area south of a line extending through the Gulf of Esquibel and Ernest Sound (fig. 5). Within this area populations were rather sporadic east of Clarence Strait. Collections containing eleven or more larvae per three branch sample were scattered over this entire area as were collections containing two or less larvae per three branch sample.

To the west of Clarence Strait the heavier populations were concentrated for the most part in Karta Bay, the easterly portion of Skowl Arm and Cholmondely Sound, the southern tip of Prince of Wales Island, and the islands west of Craig.

This survey was made during the weeks just before budworm pupation and collections were made until pupae were encountered in the field collections. This is the period of heaviest budworm feeding, yet very little noticeable feeding damage was observed from the air, except that moderate feeding was evident in parts of Karta Bay. Light feeding damage was observed from the ground at most of the collection points. It is believed that rain and wind caused most of the dead and dying foliage to fall to the ground. This type of feeding damage would probably be evident from the air in years of light rainfall.

EGG SURVEY - 1960-61 OVERWINTERING POPULATIONS

Purpose - The primary purpose was to determine the population trend of the black-headed budworm and the hemlock sawfly and secondarily to show the relative population levels of these two insects within the infestation area.

Methods - This survey was made by G. L. Downing and R. L. Tierney from September 27 to October 7. The methods used were approximately the same as those used in the egg survey of the previous generation of these two insects. The sample from each location consisted of five ten-inch branches from each of three different hemlock trees or a total of fifteen ten-inch branches per location. All branch samples were taken from the beach fringe. The main difference between the spring egg survey and the fall egg survey was in the method of obtaining each sample. In the spring survey all samples were obtained with hand clippers from within hand reach of the ground, or in a few cases by climbing into the lower branches of small trees. In the fall survey all samples were obtained with the aid of a nine foot aluminum pole pruner. Use of the pole pruner speeded up the collection of samples considerably and provided more uniform samples with respect to foliage type and sample height than were possible by hand clipping. By the hand clipping method many hemlock trees were not sampled because their branches were a few feet beyond hand reach.

The Alaska Forest Research Center's Hollis field station was the headquarters for this survey. The sampling sites were reached by use of a chartered Cessna 180 aircraft on floats.

It was not necessary to refrigerate the branch samples prior to egg counts, as temperatures during the survey period were low enough to prevent needle drop.

Results - A sharp decline in black-headed budworm populations throughout the entire infestation area is evident when the results of the spring and fall egg surveys are compared (figs. 2 and 6). The 1959-60 black-headed budworm generation had a mean of 2.0 eggs per ten-inch twig. For the 1960-61 generation the mean dropped to 0.3 eggs per ten-inch twig. Without exception, fall collections had fewer eggs per ten-inch twig than spring collections from the same areas. The Salt Chuck in Karta Bay was the only area where spring and fall sampling showed the population realtively unchanged, ranging from 2.2 eggs per twig in the spring to 2.0 in the fall. The comparison between the two budworm generations by locations is not as conclusive as it might be because there were relatively few repeat samples. It was planned to repeat sample all of the areas samples in the spring but weather and sea conditions prevented airplane landings in many of these areas in the fall.

A total of sixty-two egg samples of the 1960-61 budworm generation were obtained.

No hemlock sawfly eggs were found on any of these samples.

CONCLUSIONS

Piecing together the buildup and decline of this infestion is difficult. No sampling was done in 1958, and only a few samples were gathered in 1959. Almost the entire sampling effort was made in 1960. In looking back it appears that some buildup occurred in 1958, and increased during 1959, with a carry-over into 1960. Egg samples of the 1959-60 budworm generation showed light to moderate populations over a large part of the southern panhandle. Larval sampling of the 1959-60 generation showed populations remaining light to moderate, or occasionally heavy, throughout the larval period.

Sampling of the egg stage of the 1960-61 generation disclosed a marked decline in the population. This decline must have taken place in the late larval period or, in any case, before egg laying in the fall of 1960. The cause of this decline is not known. Disease and parasitism were not important factors. It may have been due to unfavorable weather during the larval feeding period as suggested by Silver (10). There were prolonged periods of precipitation during June and the first half of July. No definite check on this point is possible because of a lack of weather data from any of the areas where insect development data were obtained.

Populations of the hemlock sawfly are apparently influenced by many of the same factors influencing black-headed budworm populations. Past outbreaks of these two insect pests have generally coincided in terms of time and place. This most recent infestation pointed out this same relationship. The sawfly, while fluctuating greatly in numbers, was found in increased numbers in many of the same areas, during the same time interval, as the budworm. And they both declined to low levels during the same season.

Populations of these two insects will cause no more than light defoliation in any area of Southeast Alaska in 1961.

Literature Cited

1. Downing, G. L.
   1957. Western hemlock damage caused by the black-headed budworm, appraisal survey, Thayer Lake, Admiralty Island, Alaska. Alaska Forest Research Center, Juneau, Alaska. 7 pp., mimeo.

2. _____.
   1957. The recent history of destructive forest insect activity in Alaska. Forest Insect Survey Report No. 1. Alaska Forest Research Center, Juneau, Alaska. 4 pp., mimeo.

3. _____.
   1959. Hemlock sawfly. Forest Pest Leaflet 31. U. S. Forest Service. 4 pp.

4. _____.
1959. Biological evaluation of the black-headed budworm and hemlock sawfly in the hemlock-spruce stands of Southeast Alaska - season of 1959. Forest Insect Survey Report No. 5. Alaska Forest Research Center, Juneau, Alaska. 3 pp., mimeo.

5. McCambridge, W. F.
1953. The black-headed budworm on the Tongass National Forest, Alaska, season of 1953. Forest Insect Laboratory, Portland, Oregon. 16 pp., mimeo.

6. _____.
1955. The black-headed budworm on the Tongass National Forest, Alaska, season of 1955. Alaska Forest Research Center, Juneau, Alaska. 9 pp., mimeo.

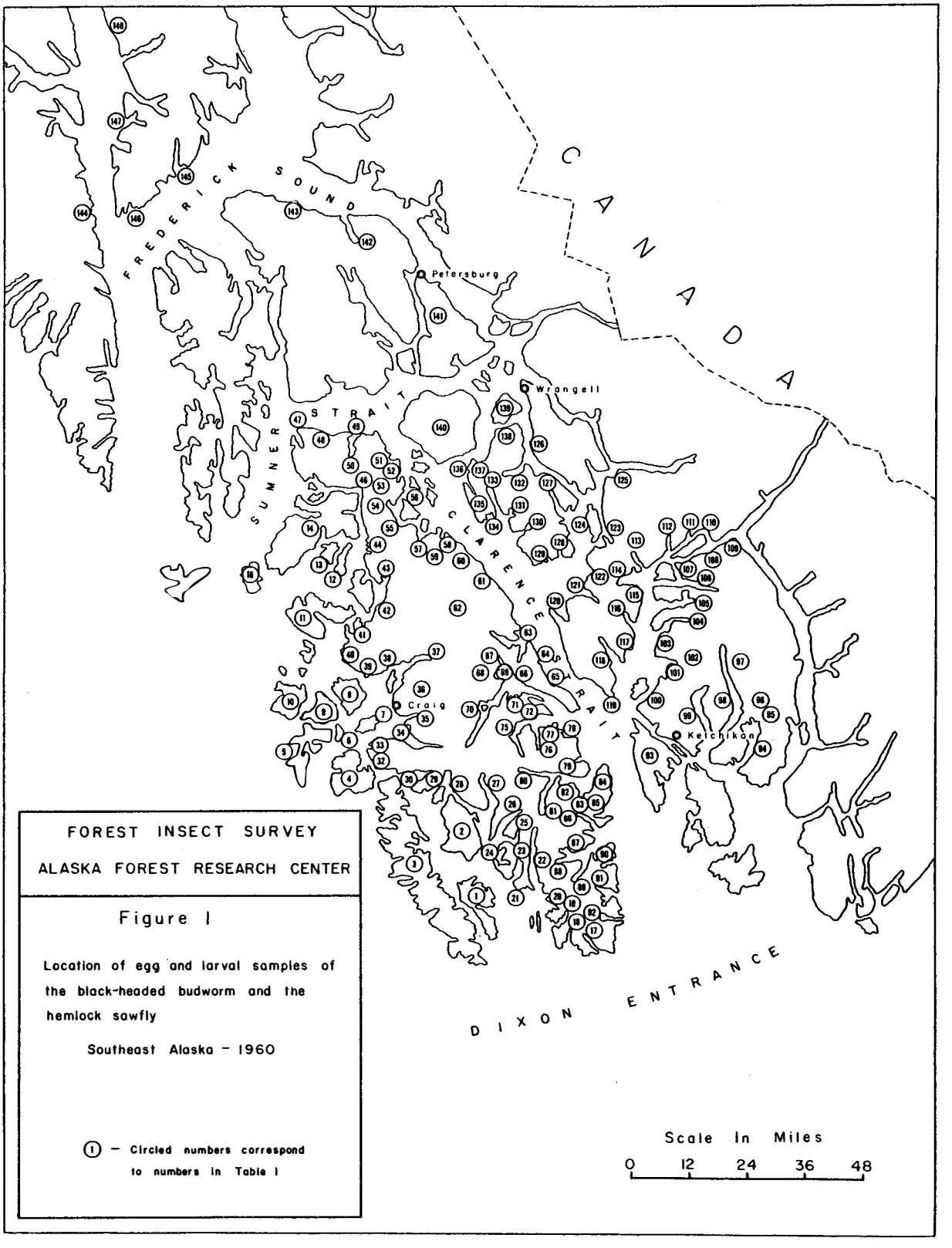
7. _____, and Downing, G. L.
1960. Black-headed budworm. Forest Pest Leaflet 45. U. S. Forest Service. 4 pp.

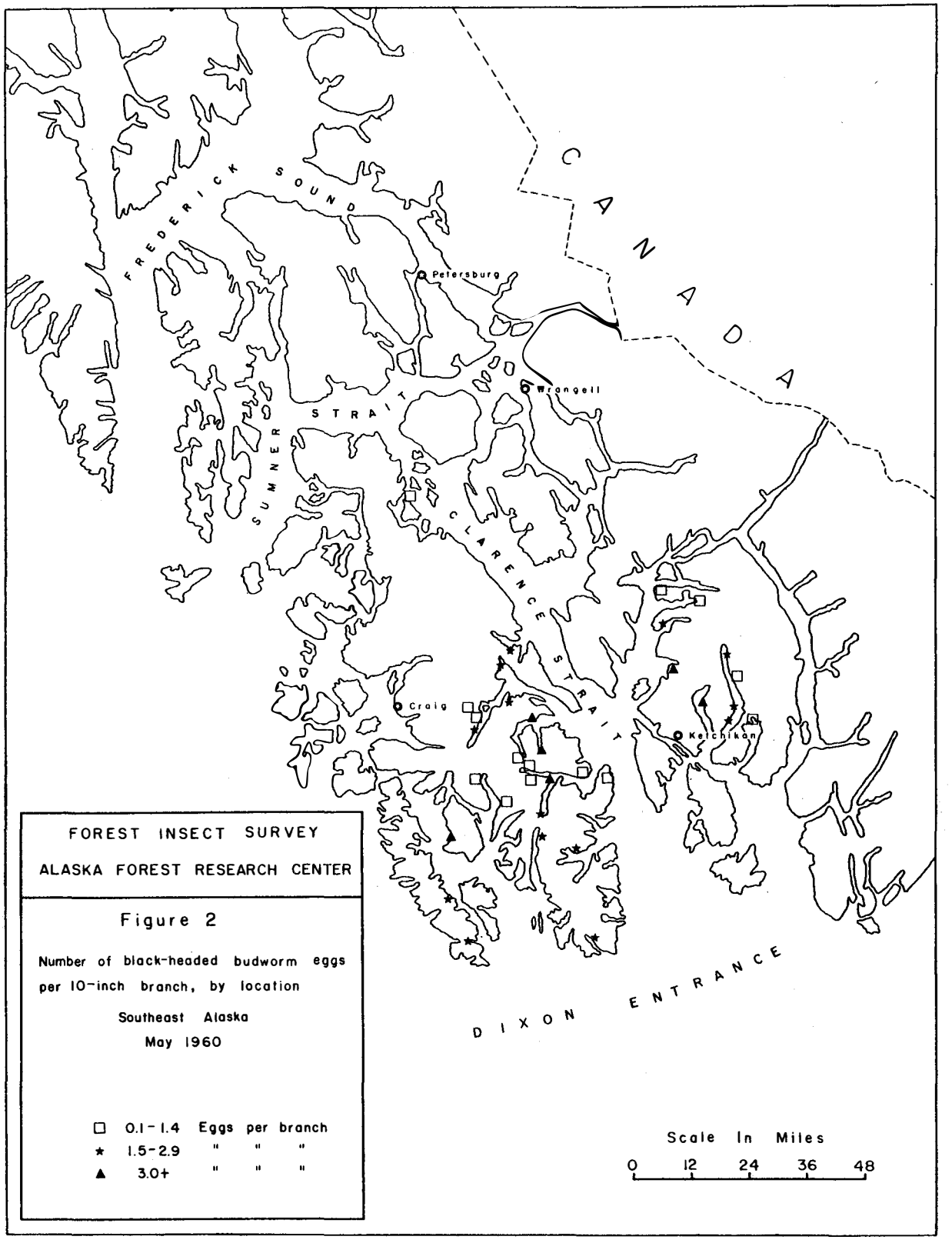
8. Silver, G. T.
1959. A method for sampling eggs of the black-headed budworm. Jour. of Forestry 57(3):203-205.

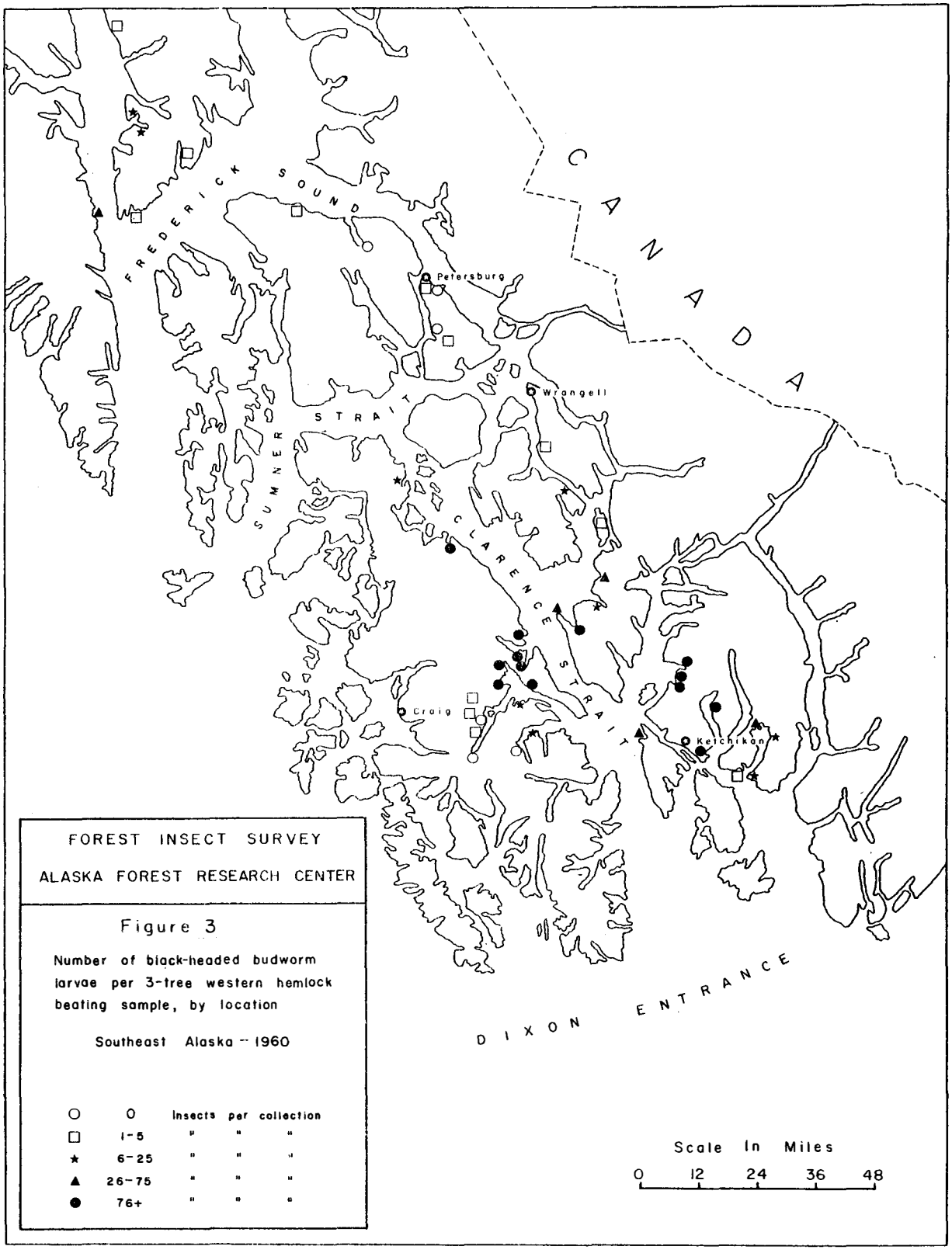
9. _____.
1959. Report on the black-headed budworm infestation on the Queen Charlotte Islands. Forest Biology Laboratory, Victoria, British Columbia. 11 pp.

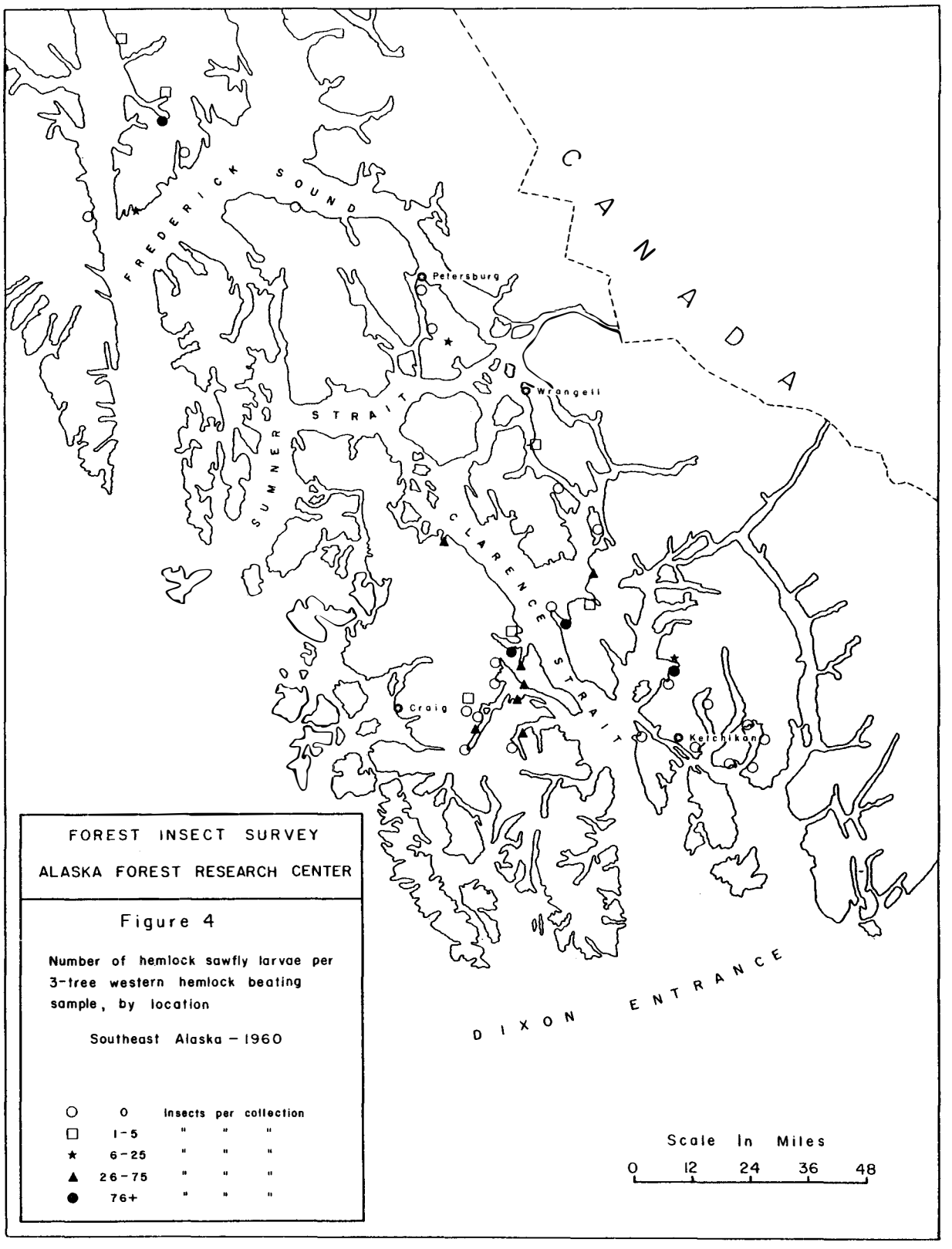
10. _____.
1960. The relation of weather to population trends of the black-headed budworm Acleris variana (Fern.). Canadian Entomologist 92(6):401-410.

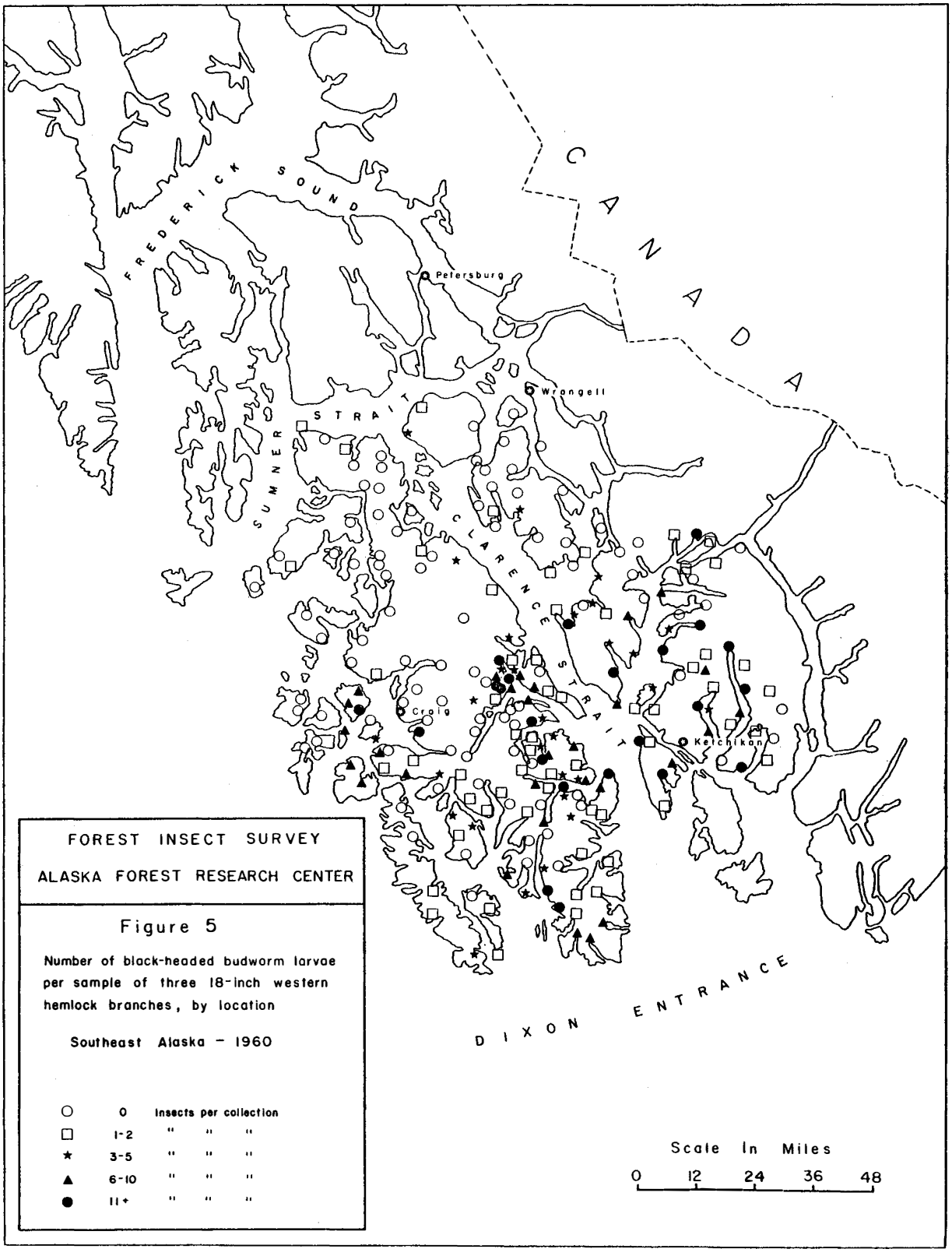
11. Taylor, R. F.
1958. Biennial report for 1956-57. Station Paper No. 2. Alaska Forest Research Center, Juneau, Alaska.


CANADA
FREDERICK SOUND
SUMNER STRAIT
CLARENCE STRAIT
DIXON ENTRANCE
Petersburg
Wrangell
Craig
Ketchikan
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 1
Location of egg and larval samples of the black-headed budworm and the hemlock sawfly
Southeast Alaska - 1960
(1) - Circled numbers correspond to numbers in Table 1
Scale in Miles
0 12 24 36 48


FREDERICK SOUND
CANADA
Petersburg
Wrangell
SUMNER STRAIT
CLARENCE STRAIT
Craig
Ketchikan
DIXON ENTRANCE
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 2
Number of black-headed budworm eggs per 10-inch branch, by location
Southeast Alaska
May 1960
0.1-1.4 Eggs per branch
1.5-2.9 " " "
3.0+ " " "
Scale In Miles
0 12 24 36 48


FREDERICK SOUND
CANADA
Petersburg
Wrangell
SUMNER STRAIT
CLARENCE STRAIT
Craig
Ketchikan
DIXON ENTRANCE
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 3
Number of black-headed budworm larvae per 3-tree western hemlock beating sample, by location
Southeast Alaska -- 1960
0 Insects per collection
1-5 " " "
6-25 " " "
26-75 " " "
76+ " " "
Scale In Miles
0 12 24 36 48


FREDERICK SOUND
CANADA
Petersburg
Wrangell
SUMNER STRAIT
CLARENCE STRAIT
Craig
Ketchikan
DIXON ENTRANCE
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 4
Number of hemlock sawfly larvae per 3-tree western hemlock beating sample, by location
Southeast Alaska – 1960
0 Insects per collection
1-5 " " "
6-25 " " "
26-75 " " "
76+ " " "
Scale In Miles
0 12 24 36 48


FREDERICK SOUND
CANADA
Petersburg
Wrangell
SUMNER STRAIT
CLARENCE STRAIT
Craig
Ketchikan
DIXON ENTRANCE
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 5
Number of black-headed budworm larvae per sample of three 18-inch western hemlock branches, by location
Southeast Alaska - 1960
0 Insects per collection
1-2 " " "
3-5 " " "
6-10 " " "
11+ " " "
Scale In Miles
0 12 24 36 48

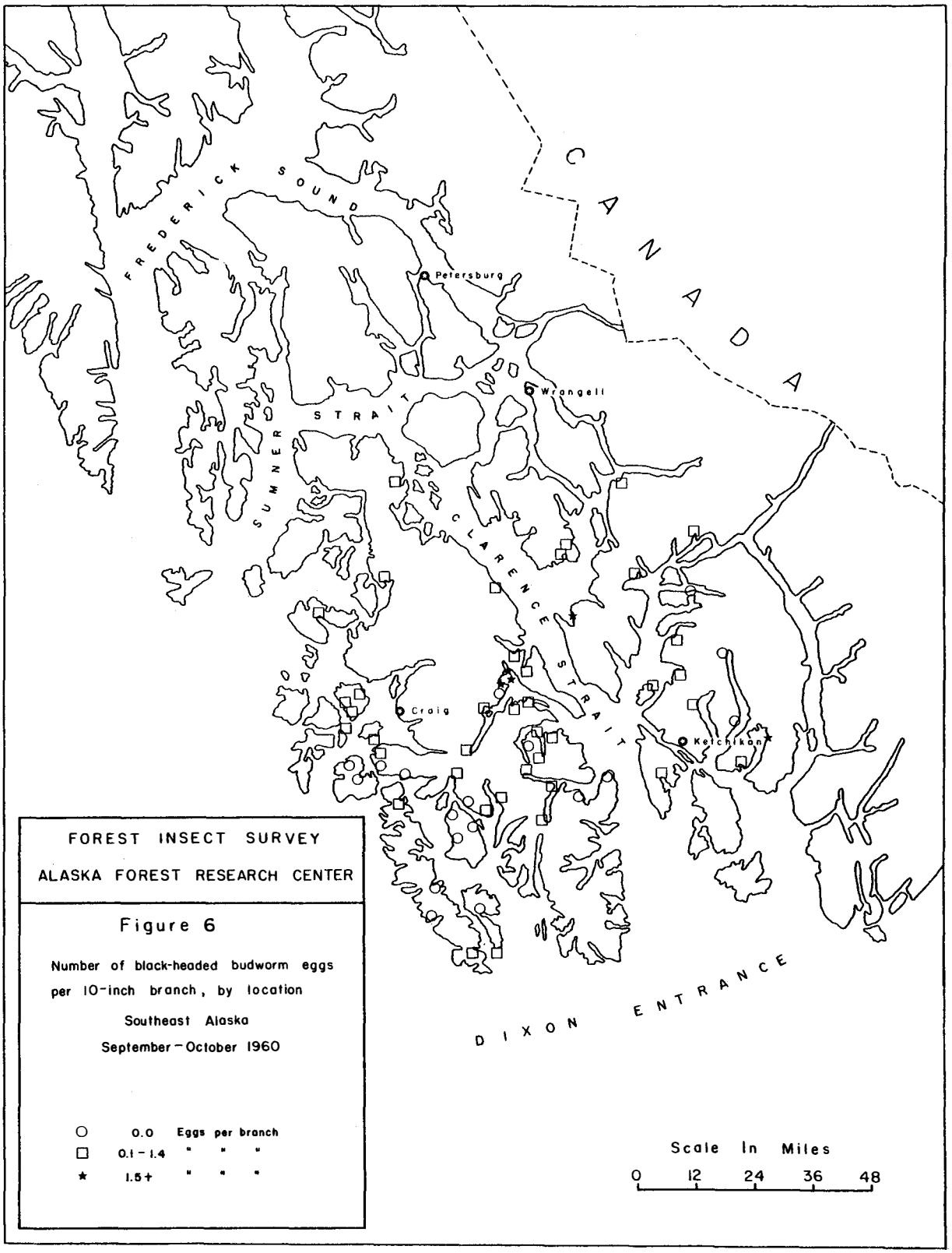

FREDERICK SOUND
CANADA
Petersburg
Wrangell
SUMNER STRAIT
CLARENCE STRAIT
Craig
Ketchikan
DIXON ENTRANCE
FOREST INSECT SURVEY
ALASKA FOREST RESEARCH CENTER
Figure 6
Number of black-headed budworm eggs per 10-inch branch, by location
Southeast Alaska
September - October 1960
0.0 Eggs per branch
0.1 - 1.4 " " "
1.5+ " " "
Scale In Miles
0 12 24 36 48

Table 1. Survey data of black-headed budworm and hemlock sawfly infestation, Southeast Alaska, 1960.

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
1	Long Is.							
	Kaigani Pt.		0.1		1		0.0	
	Coning Inlet		0.0		1		0.0	
	Dora Bay				0			
2	Sukkwan Is.							
	Kasook Inlet				0			
	Dunbar Inlet	5.1	0.0*		1	0.0	0.0*	
	Eastside of Is.		0.0		5		0.0	
	South Pass		0.0*		4		0.0*	
3	Dall Is.							
	Datzkoo Harbor	2.8	0.1		3	4.7	0.0	
	Port Bazan		0.0		1		0.0	
	Ham Cove	1.5				0.0		
	Rose Inlet		0.0**		1		0.0**	
	View Cove				0			
	Farallon Bay				0			
	North Bay		0.1				0.0	
4	Suemez Is.							
	Port Refugio		0.0		6		0.0	
	Port Dolores		0.0		7		0.0	
5	Baker Is.							
	Port San Antonio				0			
	Port Asumcion				0			
6	St. Ignace Is.		0.1		7		0.0	
7	San Juan Batista Is.							
	South		0.3		4		0.0	
	North				0			

1/ Numbers refer to circled numbers on map, figure 1.

2/ Based on 15 branches per location, except * indicates 10 branches and ** indicates 5 branches.

3/ One tree beating samples indicated by #.

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
8	San Fernando Is.							
	Pt. Cuerbo		0.9		12		0.0	
	Pt. Polocano		0.7		7		0.0	
	Portillo Channel		0.9		9		0.0	
9	Lulu Is.				0			
10	Noyes Is.							
	St. Nichols Channel				0			
	Steamboat Bay				0			
11	Heceta Is.							
	Pt. Desconocida				0			
	Warm Chuck Inlet		0.1				0.0	
	Port Alice				0			
12	Orr Is.				0			
13	Marble Is.				0			
14	Kosciusko Is.							
	Edna Bay				1			
	Cape Pole				0			
	Devilfish Bay				0			
16	Warren Is.				0			
	Prince of Wales Is.							
17	Nichols Bay	2.1			7	0.0		
18	Brownson Bay				7			
19	Hessa Inlet				1			
20	Hunter Bay				22			
21	Shipwreck Pt.				3			
22	Klakas Inlet							
	Mouth				24			
	Midway				3			
	Head	1.5			0	0.0		
23	Kassa Inlet				0			
24	Mabel Bay				8			
25	Keete Inlet				0			

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
26	Nutkwa Inlet				2			
27	Hetta Inlet							
	Hetta Lake	0.1			0			
	Copper Harbor		0.1		1		0.0	
	Perry Ck.	0.5			0	0.1		
	Eek Inlet		0.1		2		0.0	
28	Hydaburg							
	South		0.0		1		0.0	
	North		0.1		1		0.0	
29	North Pass				0			
30	Soda Bay Area							
	Soda Bay				3			
	Tlevak St. - head		0.0		8		0.0	
32	Waterfall		0.0		2		0.0	
33	Port Estrella		0.1		6		0.0	
34	Trocadero Bay							
	Port Caldera				0			
	Midway, south				1			
	Head				0			
	Pt. Miraballis				9			
35	Port St. Nicholas				0			
	Craig				0			
36	Klawak Lake							
	South				0			
	North				0			
37	Big Salt Lake				0			
38	Shinaku Inlet				0			
39	Burnt Pt.				2			
40	Bob's Place				0			
41	Nossuk Bay				0			
42	Tuxekan Passage				0			
43	Naukati Bay		0.5		0		0.0	

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
44	Deweyville Area							
	Sarkar Lake				0			
	Deweyville				0			
46	Aneskett Pt.				0			
47	Pt. Baker				1			
48	E. of Pt. Baker				0			
49	Red Bay				1			
50	Red Lake				0			
51	Salmon Bay Lake							
	North				0			
	South				0			
52	Exchange Cove		0.2	15			0.0	
53	Lake W. of Exc. Cove				0			
54	Neck Islands Lake				0			
55	Whale Passage				0			
56	Thorne Is., north	0.2			0	0.0		
57	Barnes Lake				1			
58	Coffman Cove			76				70
59	Sweetwater Lake							
	North				0			
	South				0			
60	Luck Lake				3			
61	Little Ratz Harbor		0.3		2		0.0	
62	Thorne Lake				0			
63	Thorne Bay Area							
	North				4			
	South	2.2	0.4	175		0.0	0.0	125
	Snug Anchorage			356				2
	Tolstoi Bay, north				2			
	" " , south		0.7	345			0.0	33
64	Windfall Harbor				0			
65	Lyman Anchorage				2			

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
66	Kasaan Area							
	Mt. Kasaan				1			
	Pt. Adams			215#	9			64#
	Mills Bay				7			
67	Salt Chuck Area							
	Westside				14			
	"			82	3			0
	Mouth				2			
	"	2.2	2.0		3	0.0	0.0	
68	Salmon Lakes Area							
	Salmon Lake				0			
	Little Salmon Lake				0			
69	Karta Bay Area							
	Paul Young Ck.				1			
	" " "				4			
	West				9			
	South		1.6		21		0.0	
	"			462	10			0
	"				88			
	Island		1.5		27		0.0	
	South of Sandy Pt.				7			
70	12 Mile Arm Area							
	Boathouse		0.0		1		0.0	
	Clark Bay				1			
	Maybeso Ck.			3	5			3
	Cat Is. Camp		0.1				0.0	
	Harris River	0.4		4		0.0		0
	South of Cat Is.	0.4		0	0	0.0		0
	Midway, west	1.5		1	0	0.0		43
	Head		0.1	0	0		0.0	0
	Opposite Loy Is.				0			
71	Kina Cove to Baker Pt.							

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
	Kina Cove	2.7	1.1		0	0.9	0.0	
	Coal Bay			21	0			37
	Baker Pt.		0.1		6		0.0	
72	Smith Lag. to Old Franks L.							
	Smith Lagoon				3			
	Old Kasaan Nat'l. Mon.	4.7			52	0.0		
	Old Franks Lake				0			
75	Polk Inlet Area							
	Old Franks Ck.				2			
	Dog Salmon Ck.			0	0			0
	Head	0.3			0	0.0		
	Opp. Dog Salmon Ck.		0.0		2		0.0	
	Near Mouth, east			7#	1			16#
76	McKenzie Inlet Area							
	Paul Bite		0.1		2		0.0	
	Midway, west				4			
	Near Head, west		0.1		2		0.0	
	Head				6			
	"				23			
	Near Head, east	4.1			7	0.0		
77	Saltery Cove		0.2		4		0.0	
78	Trollers Cove				10			
79	Clover Bay to Sunny Cove							
	Clover Bay				1			
	Chomly Sd., north	0.9			7	0.0		
	" " "				5			
	Sunny Cove				5			
80	West Arm Area							
	Mouth, north				2			
	Head, north	0.9	0.5		2	0.0	0.0	
	Midway, south	1.3			6	0.0		
81	South Arm Area							

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
	Mouth, west	4.6	0.8		2	0.0	0.0	
	Midway, west				0			
	Head	1.6	0.3		7	0.0	0.0	
82	Divide Head to Babe Is.							
	Divide Head				15			
	Dora Bay				1			
	Near Dora Lake				6			
	West of Babe Is.				0			
83	Kitkun Bay Area							
	Mouth, west		0.0		0		0.0	
	Head				2			
84	Hump Is. to Windy Pt.							
	East of Hump Is.				10			
	Chasina Pt.		0.0		14		0.0	
	Windy Pt.	1.4				0.0		
85	Paul Lake				2			
86	Miller Lake				3			
87	Kegan Lake	1.9			1	0.0		
88	Frederick Cove				0			
89	South Arm - Moira Sd.				1			
90	Johnson Cove				1			
91	Kendrick Bay				1			
92	McLean Arm				8			
93	Gravina Is.							
	Dall Bay				2			
	Bostwick Inlet		0.3		16		0.0	
	Vallenar Bay			39				0
	" "				1			
	" "				11			
	Blank Inlet				6			
94	Thorne Arm Area							
	Coho Cove			3				0

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
	Moth Bay		0.1		11		0.0	
	Mouth			23				0
	Notch Mtn.				1			
	Sea Level Mine		1.5	13	0		0.0	0
	Mink Is.	1.3		44	2	2.5		0
95	Ella Lake				0			
96	Mirror Lake				1			
97	Swan Lake				2			
98	Carroll Inlet Area							
	Carroll Ck	2.9	0.0		11	0.0	0.0	
	Calamity Ck.	0.7			14	0.1		
	Island Pt.	2.2			8	0.0		
	Hume Is.	2.7	0.0		1	0.1	0.0	
	Carroll Pt.				0			
99	George Inlet Area							
	Coon Cove	4.2		155	3	4.9		0
	Salt Lagoon				1			
	White River		1.1		16		0.0	
	Beaver Falls				6			
	Cannery			59				0
100	Clover Pass. Area							
	Clover Passage				1			
	Betton Is., south				1			
	Betton Is., north		0.5		5		0.0	
101	Naha Bay Area							
	Moser Bay			97				0
	Long Arm	6.1	0.1	232	0	0.1	0.0	108
	South of Loring			177				14
102	East of Naha Bay							
	Heckman Lake				1			
	Patching Lake, south				6			
	" " , north				1			
103	Francis Cove				12			

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
104	Traitors Cove Area							
	West	2.3	0.2		3	4.7	0.0	
	Head				11			
105	Neets Bay Area							
	Rockfish Cove				0			
	Head	1.0			0	0.0		
106	Gedney Pass Area							
	Mouth	0.3			7	0.0		
	Dress Pt.		0.0		0		0.0	
107	Curlew Pt.				1			
108	Behm Narrows				1			
109	Pt. Whaley				0			
110	Anchor Pass				2			
111	Short Bay		0.2		12		0.0	
112	Bailey Bay				2			
113	Lake McDonald				0			
114	Spacious Bay		0.1		0		0.0	
115	Snail Pt.				0			
116	Port Stewart				6			
117	Granite Ck.				3			
118	Helm Bay Area							
	Helm Bay				5			
	Smugglers Cove				23			
119	Caamano Pt.				9			
120	Union Bay							
	Lemesurier Pt.			44	2			0
	Head			340	23			170
	Cannery		1.7		3		0.0	
121	Vixen Inlet Area							
	Vixen Harbor				0			
	Vixen Inlet			22	5			
	Vixen Inlet Lake				1			

No.[1]	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br.[2]		No. of larvae		No. eggs/10" br.[2]		No. of larvae[3]
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
122	Emerald Bay			66	3			49
123	Santa Anna Inlet				0			
124	Deer Is.			3	0			0
125	Anan Ck.		0.4				0.0	
126	Nemo Pt.			3	0			1
127	Zimovia St., south			8	0			0
128	Brownson Is.							
	North		0.2		0		0.0	
	East				1			
	West		0.1				0.0	
	South				0			
	Etolin Is.							
129	Near Krogh Lake				1			
130	McHenry Inlet				0			
131	Burnett Inlet							
	South				3			
	North				0			
132	Anita Bay				0			
133	Mosman Inlet							
	North				0			
	South				1			
134	Cooney Cove				0			
135	Johnson Cove				0			
136	Steamer Pt.				0			
137	Quiet Harbor				0			
138	North end of Is.				0			
139	Woronkofski Is.				0			
140	Zarembo Is.							
	Meter Bight				0			
	Macnomara Pt.				3			
	Pt. St. John				1			

No. 1/	Location	Black-headed budworm				Hemlock sawfly		
		No. eggs/10" br. 2/		No. of larvae		No. eggs/10" br. 2/		No. of larvae 3/
		spring	fall	/3-tree beating	/3-18" branches	spring	fall	/3-tree beating
141	Mitkof Is.							
	Near Crystal Lake			3				6
	Near Rock Pt.			0				0
	Near Scow Bay			2				0
	Petersburg			0				1
	Kupreanof Is.							
142	Portage Bay			0				
143	Pinta Pt.			1				0
	Baranof Is.							
144	Warm Sprs. Bay			37				0
	Admiralty Is.							
145	Eliza Harbor			3				0
146	Tyee			4				12
147	Hood Bay							
	South Arm			9				121
	North Arm			16				2
148	Thayer Ck.			5				2
	West side of Admiralty Is. north of area covered on map fig. 1.							
	Hawk Inlet			0				0
	Funter Bay			0				0